



Quantification Tools for Analyzing Tomograms of Energy Materials

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Quantification Tools for Analyzing Tomograms of Energy Materials

Monica Jane Emerson, Anders Bjorholm Dahl, Rasmus Larsen

MOTIVATION

The efficiency and lifetime of devices depends critically on the details of the materials' 3D microstructure and the relation between such structures. Recently developed X-ray imaging techniques provide a resolution that allows for seeing inside a device without destroying it.

There are a number of analysis tasks that need to be carried out in order to harvest the benefits from state of the art X-ray imaging techniques. This includes image segmentation of the reconstructed volumes. It is not feasible to segment manually, this could take months.

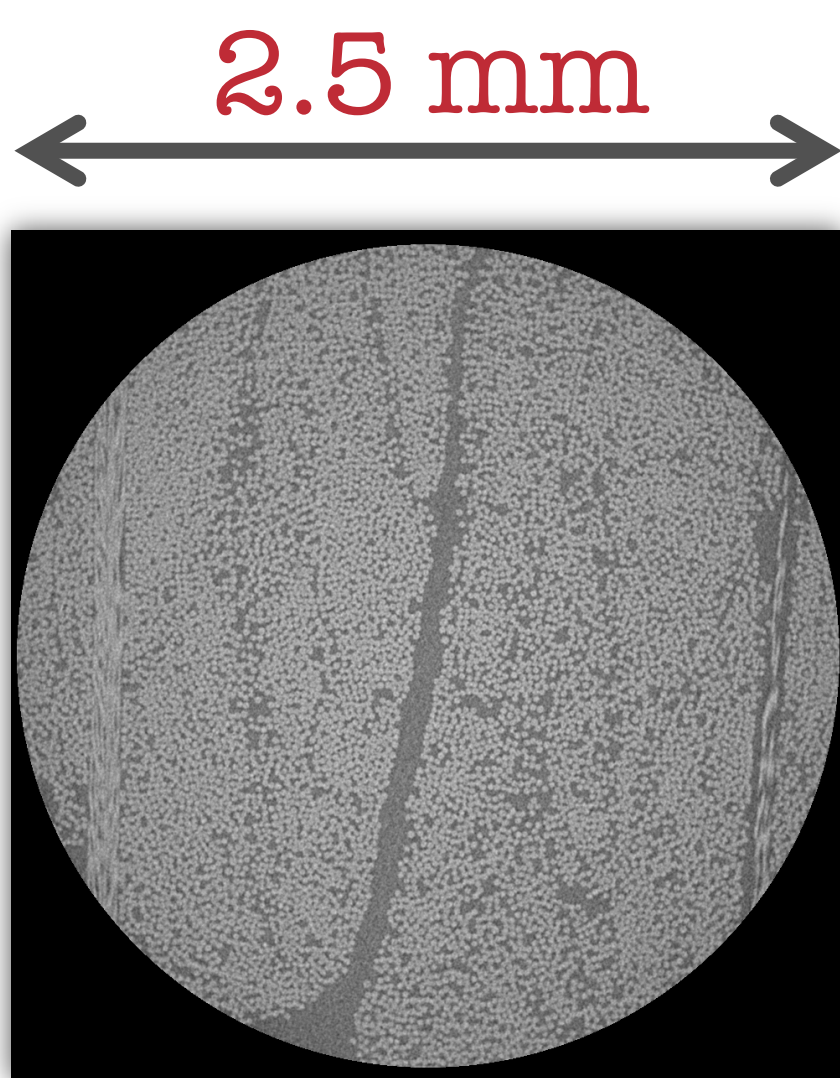
By segmenting structures we are able to measure size and shape and quantify important structures. Examples include pores and interface distributions in a catalyst, or glass fiber size, shape and length distributions in a wind turbine blade.



DATA

Currently working on 3D tomographic data from a wind turbine glass fiber.

One Slice → 2D Image



CHALLENGES

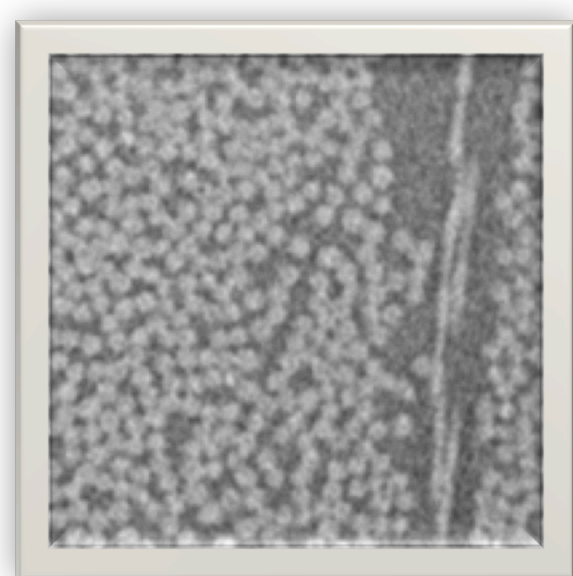
1. The different image structures do not deviate in average intensity, only in the local image structure (texture).
2. The data sets are very big and the analysis cannot be performed on the whole volume at once.

METHOD

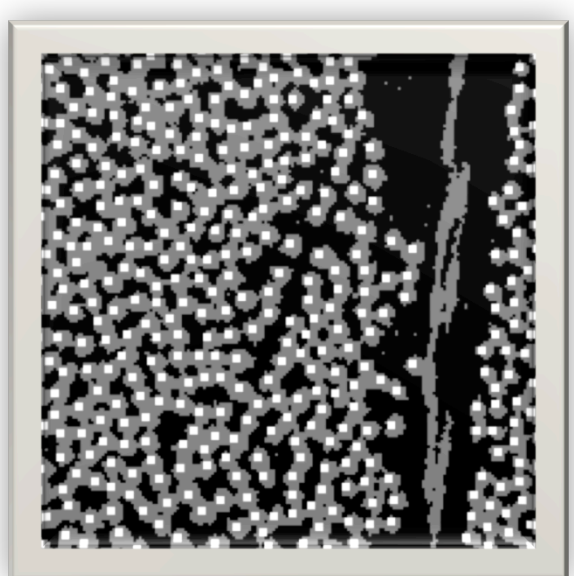
Learning dictionaries of discriminative image patches [1].

2D ANALYSIS

- TRAINING



Training image



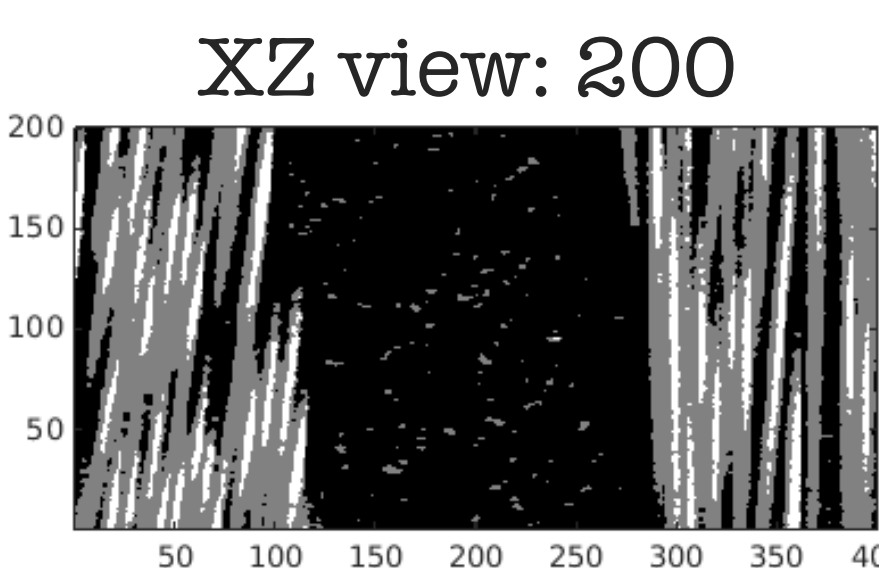
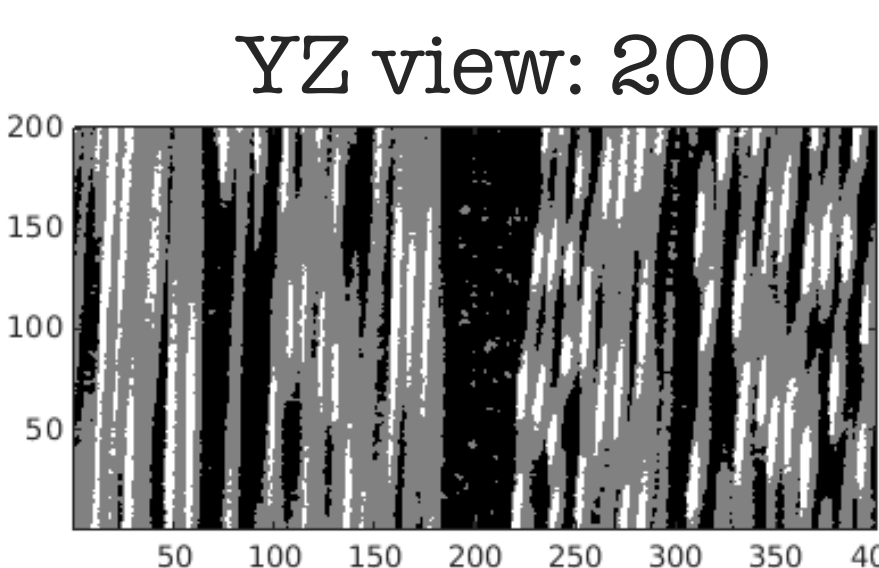
Labeling



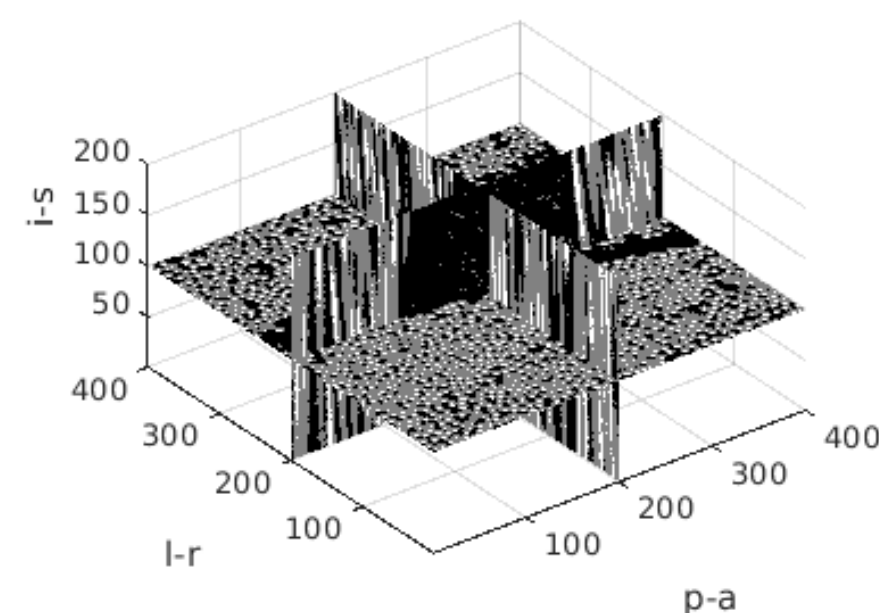
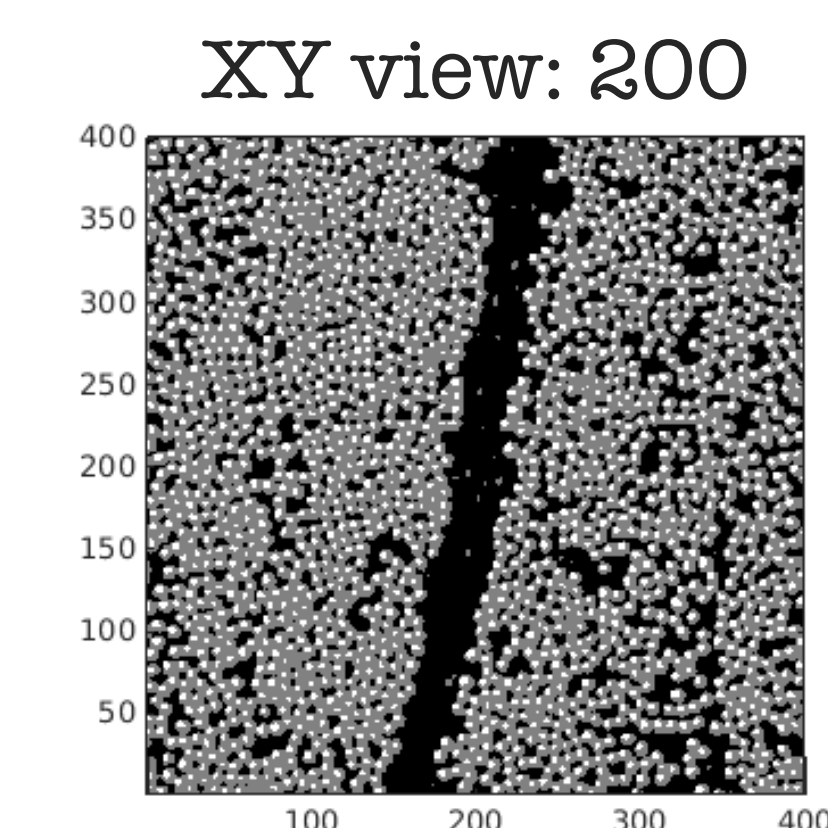
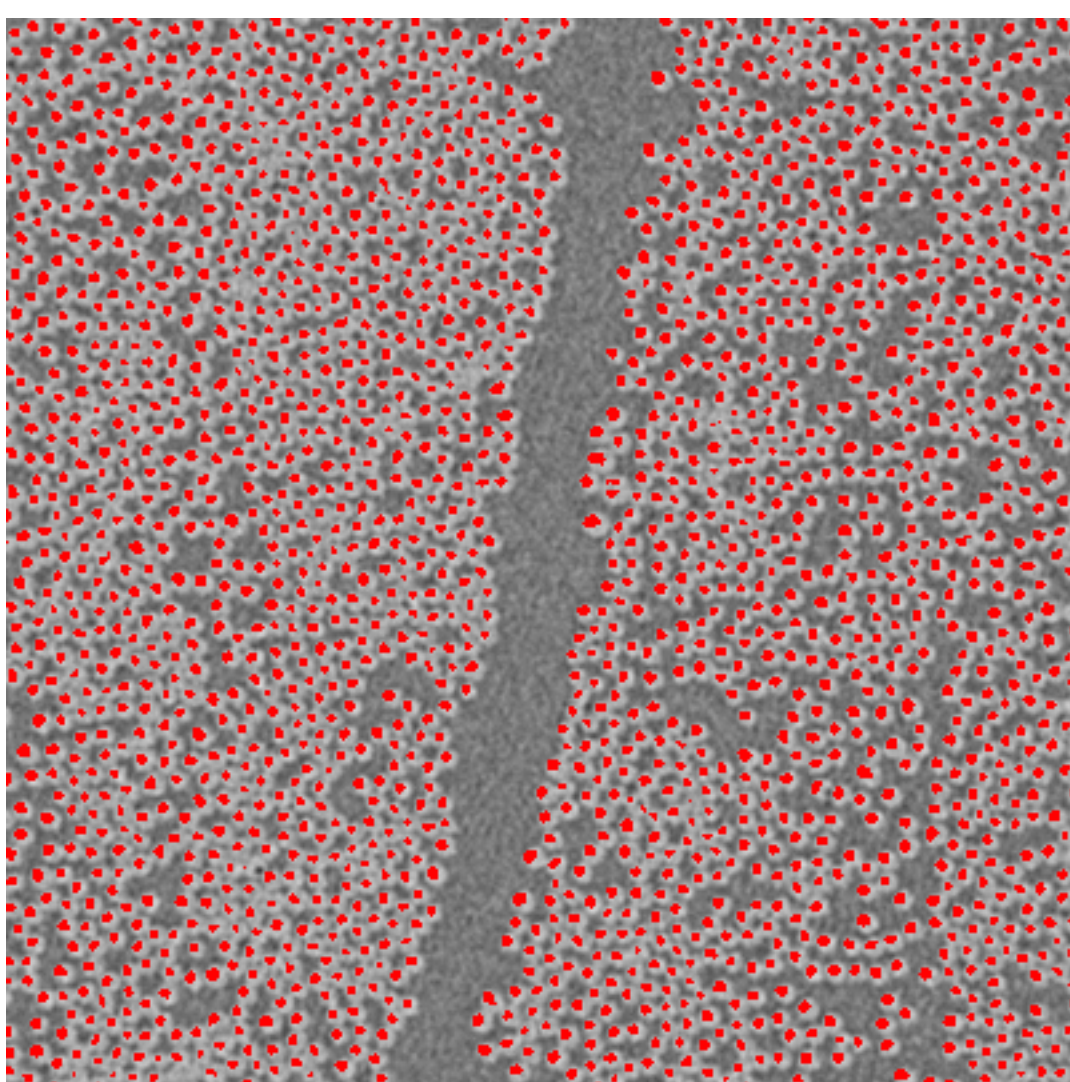
Training dictionary with a part of a 2D slice to detect 3 classes:

1. Fiber (gray)
2. Polyester (black)
3. Center of fibers (white)

- CLASSIFICATION RESULTS (3D VOLUME)



XY view: 100 with fiber centers marked



FUTURE WORK

3D analysis via implementing the dictionary method to work over voxels instead of pixels. In other words, texture/structure information from the third direction is taken into account .

Additional information will lead to:

1. Higher computational cost
2. Greater performance granting an improved segmentation.

Moreover, a larger training set will be used so as to characterize better the different classes , which will provide improved results.

ACKNOWLEDGEMENT

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“the al- lianCe for ImagiNG of Energy Materials”

REFERENCES

[1] Dahl, A., & Larsen, R. (2011). Learning Dictionaries of Discriminative Image Patches. Proceedings of the British Machine Vision Conference 2011, 77.1–77.11.